

## NAVIGATION.

## STAGE OF WATER IN RIVERS.

In the following table are shown the danger points at the various river stations; the highest and lowest stages for May, 1885, with dates of occurrence, and the monthly ranges:

Heights of rivers above low-water mark, May, 1885.

[Expressed in feet and tenths.]

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
<i>Red River:</i>						
Shreveport, Louisiana.....	29 9	11, 12	30 5	1	21 1	9 4
<i>Arkansas:</i>						
Fort Smith, Arkansas.....	15 0	20	19 2	14	8 5	10 7
Little Rock, Arkansas.....	23 0	1	24 0	18	9 7	14 3
<i>Missouri:</i>						
Yankton, Dakota.....	24 0	30	13 0	14, 15	8 3	4 7
Omaha, Nebraska.....	18 0	31	9 5	17	7 2	2 3
Leavenworth, Kansas.....	20 0	30, 31	11 9	16	9 3	2 6
<i>Mississippi:</i>						
Saint Paul, Minnesota.....	14 5	1	7 0	22	4 6	2 4
La Crosse, Wisconsin.....	24 0	3, 4, 5	10 4	31	7 5	2 9
Dubuque, Iowa.....	16 0	6, 7	12 5	24	8 8	3 7
Davenport, Iowa.....	15 0	9	10 0	26	6 5	3 5
Keokuk, Iowa.....	14 0	9	10 8	28	6 9	3 9
Saint Louis, Missouri.....	32 0	3	26 1	27	17 6	8 5
Cairo, Illinois.....	40 0	1	36 7	28	20 0	16 7
Memphis, Tennessee.....	34 0	1, 2, 3	28 2	31	14 2	14 0
Vicksburg, Mississippi.....	41 0					
New Orleans, Louisiana.....	-3 0	16, 17	-2 3	31	-4 1	1 8
<i>Ohio:</i>						
Pittsburg, Pennsylvania.....	22 0	26, 31	7 1	21	3 2	3 9
Cincinnati, Ohio.....	50 0	31	20 0	23, 24	10 8	9 2
Louisville, Kentucky.....	25 0	1	8 8	24, 25	5 5	3 3
<i>Cumberland:</i>						
Nashville, Tennessee.....	40 0	31	22 1	22	4 6	17 5
<i>Tennessee:</i>						
Knoxville, Tennessee.....						
Chattanooga, Tennessee.....	33 0	31	14 0	20	3 4	10 6
<i>Monongahela:</i>						
Pittsburg, Pennsylvania.....	29 0	26, 31	7 1	21	3 2	3 9
<i>Savannah:</i>						
Augusta, Georgia.....	32 0	25	13 8	11 to 20	6 5	7 3
<i>Mobile:</i>						
Mobile, Alabama.....		6	18 9	23	15 0	3 9
<i>Sacramento:</i>						
Red Bluff, California.....		1-8, 14	1 2	28 to 31	0 8	0 4
Sacramento, California.....		7, 8	13 9	31	11 0	2 9
<i>Willamette:</i>						
Portland, Oregon.....		24	13 8	1, 2	6 4	7 4
<i>Colorado:</i>						
Yuma, Arizona.....		21, 22	22 0	5, 6	18 3	3 7

\* Below high-water mark of 1874 and 1883.

In the Mississippi river, from Memphis northward, the highest stages of water occurred between the 1st and 9th, and the lowest stages between the 22d and 31st. At New Orleans, Louisiana, the river was highest on the 16th and 17th, and lowest on the 31st.

The Missouri river reached its lowest stage about the middle of the month and was highest on the 30th and 31st.

The Ohio was lowest between the 21st and 25th. It was highest at Louisville, Kentucky, on the 1st; Cincinnati, Ohio, on the 31st, and Pittsburg, Pennsylvania, on the 26th and 31st.

The Red river at Shreveport, Louisiana, passed the danger line on the 10th, and reached its highest stage on the 11th, when it was six-tenths of a foot above the danger line.

## ICE IN RIVERS AND HARBORS.

Buffalo, New York: floating ice fields were observed in the river on the 5th. The river and lake were free from ice on the 15th.

Oswego, New York, 6th: the harbor was free from ice on the 6th. The first vessel (schooner "Vienna") of the season arrived on the above date.

Erie, Pennsylvania: the tug "Mattison" was surrounded by an ice-floe near this port on the 2d, and narrowly escaped being wrecked.

Escanaba, Michigan: a field of ice was encountered by the steamer "Lady Washington" off Light House Point on the 5th. The first boat of the season, from Lake Michigan, arrived on the 5th.

Milwaukee, Wisconsin: the propeller "Alcona," from Toledo, Ohio, reached this port on the 6th, being the first boat of the season to arrive *via* Strait of Mackinac.

Duluth, Minnesota: Lake Superior was free from ice on the 1st; on the 2d, small quantities of floating ice were observed. The propeller "Samuel F. Hodge" left this port on the 6th for the lower lakes. The propeller "Arizona" arrived from the lower lake ports on the 14th, being the first arrival of the season *via* Strait of Mackinac.

Marquette, Michigan: the steamers "Arizona," "Osceola," and "Peerless," reached the port during the night of the 11-12th, being the first arrivals of the season.

Mackinaw City: on the 1st the steamer "Van Raalte" was the first steamer of the season to pass through the Strait of Mackinac.

Petoskey, Michigan: Little Petoskey bay was entirely free from ice on the 7th, when the navigation was resumed.

Fort Totten, Dakota: on the 4th, Fort Totten bay was free from ice. On the 6th, a large ice-floe came into the bay, and in some places along the shore the ice was piled to a height of six feet; the bay was again free from ice on the 7th. Navigation was resumed on the 11th, being the same date on which it was resumed in 1884.

## HIGH TIDES.

Little Egg Harbor, New Jersey, 14th.

New York City, 8th.

New River Inlet, North Carolina, 26th.

Fort Macon, North Carolina, 15th, 16th.

## LOW TIDES.

Indianola, Texas, 10th.

## FLOODS.

Laredo, Texas: the heavy rains on the 7th and 8th caused numerous washouts on the railroads. A large part of the town was inundated, the water being four feet deep in some places.

Rio Grande City, Texas; from 10.40 a. m. to 1.30 p. m. on the 8th, 3.49 inches of rain fell, and 3.00 inches of this amount fell in one hour and five minutes—from 11.15 to 12.10. The streets were flooded in some places to a depth of two and one-half feet. From 11 a. m. to 11 p. m. the Rio Grande river rose twenty feet, overflowing the lowlands south of the city. Serious washouts occurred on the railroads to the northward, completely cutting off communication with other points. The river continued to rise during the night, and by 8 a. m. on the 9th it was twenty-nine feet above low water. At an average stage the Rio Grande river at this point is but one hundred yards wide; on the 9th its width was about five miles, extending from the plaza in Rio Grande City to Camargo, Mexico. More than two thousand acres of growing crops between Rio Grande City and Camargo were inundated. At noon on the 9th the river became stationary, and at 9 p. m. began to fall slowly.

Edinburg, Texas, 11th: the recent heavy rains caused the Rio Grande river to overflow, submerging a large area of planted corn.

San Antonio, Texas: a very heavy rainfall occurred on the 13th, flooding the western part of the town. The water entered many houses, and one house was moved from its foundation.

Elk Falls, Elk county, Kansas: during the afternoon of the 15th one of the heaviest rain-storms occurred that has ever been experienced in this vicinity. The lowlands were inundated and several lives lost. The railroads were badly washed.

Independence, Montgomery county, Kansas: the heavy rains during the night of the 15-16th caused Elk and Verdigris creeks to overflow. Six persons were drowned in Card creek, seven miles west of Independence. A large number of cattle were drowned and many bridges were washed away. Elk creek reached a height four feet higher than in any previous flood. Verdigris creek was also higher by sixteen inches than ever before known.

Montrose, Colorado: a "cloud-burst" occurred on the north side of Horse-Fly mountain on the 17th. Several culverts along Horse-Fly gulch were washed away and the roads were rendered impassable.

Caldwell, Burleson county, Texas: during the night of the 25-26th the heaviest rainfall of the season occurred. The creeks rose to a greater height than has been known for many years.

Austin, Texas: a freshet occurred here during the night of the 25-26th, causing much damage. Bouldin's and Barton's creeks overflowed, the former being higher than ever before known. Two bridges over Bouldin's creek, near Austin, were washed away. Onion creek, a large tributary to the Colorado river, reached its highest stage since 1869, and overflowed a number of farms along its banks.

Navasota, Grimes county, Texas: the heaviest rain for many years fell during the night of the 25-26th. Two bridges at this place, over Cedar creek, were washed away.

Dallas, Texas: the heavy rains of the 26th caused the Trinity river to overflow, submerging the turnpike to the west of this place.

Mexia, Limestone county, Texas: on the 26th the Navasota river was reported to have been higher than known for several years.

Indianola, Red Willow county, Nebraska: a "cloud-burst" occurred near the Republican river during the evening of the 26th. Eleven of a party of seventeen persons who were encamped in Richman canyon were drowned. The canyon was flooded to a depth of fifteen feet.

Halifax, Nova Scotia: reports from Annapolis county state that on the 27th a remarkably heavy rain fell over an area three miles in length by five or six miles in width. The streams rose to dangerous heights. At Port Lorne numerous bridges and a mill were washed away.

Valley Mills, Bosque county, Texas: a remarkably heavy rainfall occurred here during the night of the 27-28th. Two thousand feet of railroad track and two culverts were washed away between this place and Clifton, a few miles northward. The Bosque river rose to a greater height than ever before known, overflowing farms along its banks and causing a large amount of damage. Several families were compelled to abandon their houses. Reports from Meridian on the 28th stated that the damage caused by the flood in Bosque county was estimated at \$100,000.

Waco, McLennan county, Texas: the most destructive flood ever known here occurred on the 28th. A violent storm accompanied by very heavy rainfall prevailed during the night of the 27-28th. The Brazos river reached a point two feet above high water mark, and the fine cotton plantations along its banks were completely submerged. On the evening of the 30th the Brazos had fallen seven feet, but there were still about one hundred and fifty dwellings and business houses submerged. Seventeen bridges in McLennan county were washed away by the flood. It is estimated that the damage, independent of that sustained by the railroads, will aggregate \$100,000.

Evansville, Indiana: a very heavy fall of rain occurred during the afternoon of the 28th. Damage estimated at \$2,000 was caused by flooding of cellars in the northern part of the town.

Longview, Gregg county, Texas: the upper Sabine river overflowed on the 29th.

Laredo, Texas: on the 29th the Rio river was reported to have been six feet higher than ever before known.

Marlin, Falls county, Texas: on the 30th the surrounding country for a distance of several miles from the Brazos river was entirely submerged, resulting in great damage to all kinds of crops and the loss of much stock.

Calvert, Robertson county, Texas: on the 31st the Brazos river was five feet higher than any previous flood mark, and thousands of acres of land under cultivation were flooded.

#### TEMPERATURE OF WATER.

The following table shows the highest and lowest temperatures of water observed at the several stations; the monthly

ranges of water temperature; the average depth at which the observations were made; and the mean temperature of the air:

*Temperature of water for May, 1885.*

Station.	Temperature at bottom.		Range.	Average depth, feet and tenths.	Mean temperature of the air at station.
	Max.	Min.			
Atlantic City, New Jersey .....	63.7	50.7	13.0	4 9	54.8
Alpena, Michigan .....	60.5	40.0	20.5	12 2	46.5
Augusta, Georgia .....	74.5	65.2	9.3	8 0	70.0
Baltimore, Maryland .....	67.8	57.9	9.9	10 7	63.0
Block Island, Rhode Island .....	50.7	43.4	13.3	8 1	50.7
Boston, Massachusetts .....	55.8	43.3	12.5	19 7	52.3
Buffalo, New York .....	57.5	33.8	23.7	8 9	53.1
Canby, Fort, Washington Territory .....	60.2	51.1	9.1	14 4	52.6
Cedar Keys, Florida .....	82.9	74.7	8.2	7 9	75.1
Charleston, South Carolina .....	76.4	69.0	7.4	41 5	72.7
Chicago, Illinois .....	64.1	48.9	15.2	8 0	52.8
Chincoteague, Virginia .....	73.0	56.0	17.0	3 8	59.9
Cleveland, Ohio* .....	57.0	45.8	11.2	14 0	55.6
Detroit, Michigan .....	56.2	41.0	15.2	24 4	56.8
Duluth, Minnesota .....	53.1	35.6	17.5	9 9	47.0
Eastport, Maine .....	40.7	30.6	4.1	14 7	47.5
Escanaba, Michigan* .....	60.1	34.3	25.8	18 2	47.6
Galveston, Texas .....	82.5	70.5	12.0	12 9	76.2
Grand Haven, Michigan .....	69.0	46.2	22.8	19 0	52.9
Indianola, Texas .....	84.5	68.5	16.0	9 3	75.0
Jacksonville, Florida .....	83.4	73.4	10.0	18 0	73.7
Key West, Florida .....	87.2	82.2	5.0	17 0	80.4
Mackinaw City, Michigan* .....	47.5	35.8	11.7	10 0	44.4
Macon, Fort, North Carolina .....					
Marquette, Michigan .....					
Milwaukee, Wisconsin .....	50.8	41.9	8.9	8 0	49.7
Mobile, Alabama .....	81.3	71.0	10.3	17 3	71.7
New Haven, Connecticut .....	64.5	45.5	19.0	16 8	54.9
New London, Connecticut .....	55.7	43.4	12.3	12 2	54.5
New York City .....	60.0	48.0	12.0	13 8	56.2
Norfolk, Virginia .....	72.1	59.8	12.3	10 6	65.1
Pensacola, Florida .....	83.1	69.5	13.6	17 4	72.8
Portland, Maine .....	50.1	44.0	6.1	17 5	54.8
Portland, Oregon .....	64.2	53.8	10.4	61 5	58.9
Sandusky, Ohio .....	68.5	47.8	20.7	10 7	56.7
Sandy Hook, New Jersey .....	60.4	47.6	12.8	1 8	51.6
San Francisco, California .....	60.3	50.2	4.1	35 6	57.2
Savannah, Georgia .....	80.0	71.3	8.7	9 4	73.3
Smithville, North Carolina .....	79.0	66.0	13.0	10 6	69.2
Toledo, Ohio .....	70.2	47.5	22.7	13 0	57.9
Wilmington, North Carolina .....	78.1	68.4	9.7	14 4	70.1

\* Record for the month incomplete—see text.

At Cleveland, Ohio, no observation was made on the 3d, owing to breakage of the instrument; at Escanaba, Michigan, observations were interrupted by ice on the 4th and 5th; at Mackinaw City, Michigan, no observations were made, on account of ice, from the 1st to the 6th.

#### VERIFICATIONS.

##### INDICATIONS.

The detailed comparison of the tri-daily indications for May, 1885, with the telegraphic reports for the succeeding twenty-four hours, shows the general average percentage of verifications to be 83.27 per cent. The percentages for the four elements are: Weather, 87.03; direction of the wind, 81.25; temperature, 81.03; barometer, 85.52 per cent. By geographical districts, they are: For New England, 79.14; middle Atlantic states, 82.86; south Atlantic states, 83.22; eastern Gulf states, 87.71; western Gulf states, 87.11; lower lake region, 79.68; upper lake region, 77.61; Ohio valley and Tennessee, 84.20; upper Mississippi valley, 83.69; Missouri valley, 80.55; north Pacific coast region, 82.31; middle Pacific coast region, 85.67; south Pacific coast region, 95.03. There were three omissions to predict out of 3,543, or 0.01 per cent. Of the 3,540 predictions that have been made, seventy-four, or 2.09 per cent., are considered to have entirely failed; one hundred and sixty-five, or 4.66 per cent., were one-fourth verified; four hundred and sixty-three, or 13.08 per cent., were one-half verified; six hundred and fifty-two, or 18.42 per cent., were three-fourths verified; 2,186, or 61.75 per cent., were fully verified, so far as can be ascertained from the tri-daily reports.

##### CAUTIONARY SIGNALS.

During May, 1885, one hundred and sixty-eight cautionary signals were ordered. Of these, ninety-four, or 55.95 per cent.,